

ELECTRONIC DEVICES WITH BARIUM BARRIER FILM
AND PROCESS FOR MAKING SAME

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Abstract of the Disclosure

A semiconductor device having a barrier film comprising an extremely thin film formed of one or more monolayers each comprised of a two-dimensional array of metal atoms. In one exemplary aspect, the barrier film is used for preventing the diffusion of atoms of another material, such as a copper conductor, into a substrate, such as a semiconducting material or an insulating material. In one mode of making the semiconductor device, the barrier film is formed by depositing a precursor, such as a metal halide (e.g., BaF_2), onto the substrate material, and then annealing the resulting film on the substrate material to remove all of the constituents of the temporary heteroepitaxial film except for a monolayer of metal atoms left behind as attached to the surface of the substrate. A conductor, such as copper, deposited onto the barrier film is effectively prevented from diffusing into the substrate material even when the barrier film is only one or several monolayers in thickness. The extremely thin barrier film makes possible a significant increase in the component density and a corresponding reduction in the number of layers in large scale integrated circuits, as well as improved performance.

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